- About one-half (17) of the 34 days in the optimal range would have predicatable flows that can be used by regional boaters.
- About one-third (6) of those days would occur on weekends and might approach peak weekend maximums in Table 1.
- The remaining 11 "ideal" days might approach weekday maximum use levels.
- The other 17 days in the optimal range (those with less predicatable flows) might have about half the use of ideal weekdays.
- About half the 77 days in the acceptable but not optimal range would have no use; the other half would average about 5 boaters per day.
- Taken together, these assumptions suggest whitewater boating use levels would not exceed 1,500 to 2,000 segment-user days in an average water year. Because some boaters might run more than one reach on a given day, the total number of user days would probably not exceed 1,200. This is about 7% of private boating use (and 2% of all boating use) on the Lower Chattooga in recent years.

Estimating potential scenic boating use

If allowed, scenic-oriented boating could occur on several short reaches (e.g., the Lower part of Ellicott Rock, Burrells Ford to Big Bend area, Nicholson Fields). "Guesstimating" use on for these opportunities is more challenging than for whitewater-oriented opportunities, because there are few similar rivers to use for comparison (most such rivers have road access on either end).

In general, scenic-oriented boaters prefer vehicle access on both ends, so use is likely to be low. However, 1 to 2 small groups (3 to 5 people) per day might float the Nicholson Fields reach when flow levels and weather are favorable (probably fewer than 50 days a year). This is the longest scenic-oriented reach, has the easiest access (although it still involves a ¾ mile carry-in), and might be of interest to some boating-based anglers. On the other reaches, we expect less than ten scenic-oriented trips per year. Taken together, scenic boating is likely to produce less than 300 to 400 user-days per year; this is comparable to boating use on the Lower Chattooga's Section 1 (a similar reach that has good road access).

Future trends among existing and potential uses

Recreation planning requires information about future demand for existing and potential opportunities. For many recreation activities, past use may be a relatively good predictor of future use. However, some activities may be in developing or declining trends, in which case other factors should be considered. Factors that influence trends in recreational activities include population growth, economy, availability of nearby alternatives, free time, diffusion of new technologies and techniques, media and marketing images, availability of instruction, skill development opportunities, weather, fish stocking and regulation changes, equipment, demographics, and an activity's "participation cycle."

It is beyond the scope of the present report to provide detailed analysis of recreation trend information or the influence of factors named above, but we have collected some findings from recent studies or other sources including (1) a demographic profile of the Appalachian region (Pollard, 2005); (2) a summary of natural resource-related information as part of the Southern Appalachian Assessment (USFS, 1998); (3) a national survey of human-powered recreation participation (OIA, 2005); and projections of outdoor recreation participation (Cordell et al.,

1999). At the use estimation workshop, agency staff also assessed recreation use trends for specific types of activities on the Chattooga.

Demographic and visitation trends

- Demographic information suggests that population growth in the Southern Appalachian region has been consistently high in recent years. About one third of regional counties grew 20% or more in the 1990s and 2000-2003 census data suggests this growth is continuing. This is generally a faster population growth rate than the national average. (Pollard, 2005).
- Georgia is the sixth fastest growing state in the country, and it was fueled by 43% growth in the northeast counties in the 1990s. South Carolina's Appalachian counties also grew faster than the rest of the state. Increases in population were due primarily to natural increases, internal migration, and some immigration (particularly in Northern Georgia). (Pollard, 2005).
- Visitation trends on National Forests in the Southern Appalachians increased from about 7 million visitor days in 1970 to 13 million in 1980 (over an 80% increase), but that increase slowed from 1980 to 1990 (16 million, an increase of about 20%), and now appears to be keeping pace with population trends.

Overall recreation participation trends

- A review of recreation use as part of the Southern Appalachian Assessment suggests increased recreation participation in almost all activities except hunting (USFS, 1998, p. 62).
- Older and non-white populations are increasing their participation rates in recreation, and growth rates are above the regional average for these sub-groups (e.g., substantial growth is related to increases in retirees and non-white groups). However, most recreation use days (over two-thirds) are still produced by the "most active" 25% of participants, who are predominately white, male, and under age 60 (USFS, 1998).
- Vacation patterns are shifting nationally and regionally. In general, people are taking more "long weekend trips" in comparison to "traditional 2-week vacations" (USFS, 1998).

Frontcountry recreation

- Frontcountry recreation (e.g., picnicking, sightseeing, swimming, etc.) is likely to increase at slightly greater rates than population increases as more people conduct shorter recreation trips closer to home.
- For example, participation projections estimate that sightseeing in the South will increase at about the population rate of 40% from 2000 to 2020 (Bowker et al., 1999). However, projections estimate that picnicking will increase at a slightly slower rate of 32% by 2020.
- Workshop participants generally reported stable or slow growth for these activities on the Upper Chattooga.

Frontcountry and backcountry angling

- According to the National Survey on Fishing, Hunting and Wildlife-related Recreation (FWS, 2002), the number of anglers nationally declined 3% from 1996 to 2001. Examining state data for Georgia, fishing participation has been flat (rather than in decline) in recent years.

- Participation projections from the National Survey on Recreation and the Environment suggest fishing is likely to grow, but not keep pace with population. In the South, growth is expected about 20% from 2000 to 2020.
- The estimates above include all types of fishing and were not split out for different types of fishing. In contrast to flat or slightly declining participation, fly-fishing appears to be growing based on the OIA annual survey. In 1998, about 13 million people nationwide fly-fish (about 6% of adults) but this had increased to 18 million in 2004 (8%).
- Some workshop participants generally felt regional fishing use had seen considerable growth (particularly frontcountry fishing) from the mid-1970s to the late-1990s, but it appears to have been more stable since that time (Rankin, 2007). Individual segments of the river (particularly the DH segment, established in 2000) have probably seen increased use and are candidates for more growth in the future.
- Angling trends on specific rivers such as the Chattooga also depend on stocking and regulation stability. Major changes in current stocking levels, or regulation changes that favor one type of fishing over another (e.g, extending DH reach), would probably affect future use.

Backpacking

- Backpacking use appears to be flat or declining in recent years, although it saw substantial growth from the mid-1970s through the mid-1990s. From 1972 to 1992, the percentage of people in the South who participated in camping increased from 5% to 13% (USFS, 1998)
- According to the OIA survey, however, backpacking has actually declined from about 16 million participants (8%) in 1998 to 13 million (6%) in 2004.
- Going forward, participation projections estimate that backpacking in the South will increase about 23% by 2020 (Bowker et al., 1999), which would be less than the population increase.
- Group sizes and trip lengths among many backpackers are also apparently decreasing (Roggenbuck, Widner, and Williams 1994).
- Workshop participants believe that backpacking use was generally stable in the Chattooga basin in recent years.

Day hiking

- Day hiking appears to be increasing at or slightly faster than the population rate. Participation projections estimate that hiking in the South will increase about 48% by 2020 (Bowker et al., 1999).
- In contrast, the OIA survey suggests that hiking participation has been relatively stable nationwide from 1998 to 2004 (72.2 million to 75 million, both about 34%).
- Workshop participants believe that hiking has been generally stable in the Chattooga basin in recent years.

Whitewater boating

- Whitewater kayaking is a specialized recreation activity that comprises a small proportion of use in comparison to some other outdoor recreation activities. About 1 to 2% of the national population participates in whitewater kayaking (Whittaker & Shelby, 2002).

- Within whitewater kayaking, the proportion of boaters interested in "creek boating" (on smaller high gradient rivers) or Class IV-V rapids is generally small. In an Oregon study (Whittaker & Shelby, 2002), Class IV-V boaters were estimated to be 10 to 15% of all whitewater kayakers, and the Southern Appalachian region is probably similar.
- According to the OIA survey, whitewater kayaking saw growth in the mid to late 1990s, but that growth has flattened in recent years (OIA, 2005). In 1998, an estimated 4 million people kayaked (2% of adults), and by 2004 this had risen to 10 million (4.6%).
- Use data from the Lower Chattooga showed considerably higher use in the late-1990s, with a drop-off in the first part of this decade (possibly explained by several recent low water years).

Scenic boating

- Boating on less challenging rivers in canoes, tubes, or other small craft has higher participation rates than whitewater boating, and may be increasing at a greater rate.
- About 10% of the national population participates in canoeing (OIA, 2005), and an additional 3% participate in recreational (sit-on-top) kayaking. Not all this use occurs on rivers, but there is probably a larger population of potential users for floating on easy rivers.
- Scenic floating has grown consistently since 1998 (OIA, 2005); however, use of Sections 1 and 2 on the Lower Chattooga (which features scenic floating) has generally declined from peaks in the mid-1990s.

Future use conclusion

Taken together, recreation use trend information suggests that Chattooga use is likely to increase at the rate of population increases for the region, which may exceed 20% over the next decade. Within that general increase, however, some activities may increase at slightly higher rates (e.g., frontcountry recreation, day hiking, whitewater boating, and fly fishing), while others may grow more slowly (e.g., frontcountry fishing, backpacking). The actual distribution of use in the Chattooga corridor or across the seasons is less easy to predict, and may have a large influence on whether use increases create unacceptable impacts.

5. Biophysical Impacts

This chapter examines biophysical impacts from existing or potential recreation uses. For each type of impact, it describes (1) the range of likely impacts on the Upper Chattooga, (2) potential standards to consider in the LAC / NEPA process, and (3) lessons from research or management about addressing these impacts.

Introduction

Biophysical impacts refer to "on the ground" impacts (e.g., trail erosion, bare ground at camps, damaged trees, and litter) as well as impacts on wildlife species (e.g., disturbance events, attraction impacts). Two chapters of the literature review (Berger, 2007b) focus on trail/site and wildlife impacts, reviewing general knowledge, types of impacts, and ways that managers typically address them. Findings for specific impacts are in the sections below. We have also summarized general findings about biophysical impacts from that review (or other sources):

- Recreation use can have direct effects on biophysical resources (e.g., trampling of a plant species) or indirect effects (e.g., erosion that increases sedimentation in a river, which subsequently reduces fish spawning success). It is more difficult to link specific recreation use to longer term, indirect effects.
- Biophysical impacts are often but not always interrelated (e.g., trail impacts may be correlated with camp impacts). Impacts vary with type of use, behavior, and multiple environmental factors (type of vegetation, slope, soil type, etc.), so they need to be assessed on a case by case basis.
- Recreation use usually causes greater changes in biophysical impact levels during "pioneering" (initial) use, with decreasing impact as additional use occurs (Hammitt and Cole, 1998; Leung and Marion, 1996).
- Biophysical impacts can influence perceptions of crowding and the quality of recreation experiences. However, studies suggest that many recreation users are more tolerant of biophysical impacts (e.g., bare ground at camps, size of fire rings) than managers (Martin et al., 1989; Shelby, Vaske, and Harris, 1988; Manning, 1999; Hall et al., 2001).
- Understanding the causes of biophysical impacts (e.g., the types and quantities of recreation use) is important for developing strategies that reduce or mitigate them. The type of use or specific use practices is usually more important than the number of users.
- Multiple biophysical impacts may interact or have greater cumulative consequences than an individual impact (Leung and Marion, 2000; Hammitt and Cole, 1998). However, it is crucial to specify individual impacts before assuming a broader problem.

Estimates of biophysical impacts in the Upper Chattooga corridor are based on recent monitoring conducted in 2006-07 (USFSb, 2007). This included documenting all the designated and user-created trails, amount of litter along trails, the number and condition of campsites (bare ground, cleared area, cut trees, and amount of litter), sites with erosion problems, and the proportion of trail and camps within 20 feet of the river. The monitoring effort covered Forest Service lands in the basin from Grimshawes Bridge to Tugaloo Lake, including the West Fork.

This monitoring effort documents baseline information about biophysical impacts. Comparable information from the time of designation (or the intervening 30 years) is not available.

Trails and trail erosion

Trail impacts are an issue on the Upper Chattooga; the primary concern is that erosion from trails may increase sedimentation and turbidity in the river, which could have additional indirect effects on water quality and aquatic species. Trail impacts also have an aesthetic component; higher impacts associated with poor trail conditions may increase feelings of crowdedness or decrease the sense of remoteness or naturalness.

Existing impacts

USFS monitoring in 2006-07 documented the miles of designated and user-created trails and the number of sites with erosion problems along the Upper Chattooga. Findings are summarized below; more detailed information is available in the Forest Service report (USFS, 2007b).

There are 35.0 miles of designated trails and 19.3 miles of user-created trails in the Upper Chattooga corridor. This compares with 45.2 miles of designated trails and 33.1 miles of user-created trails along the lower river. Miles of each type per segment are given in Figure 4.

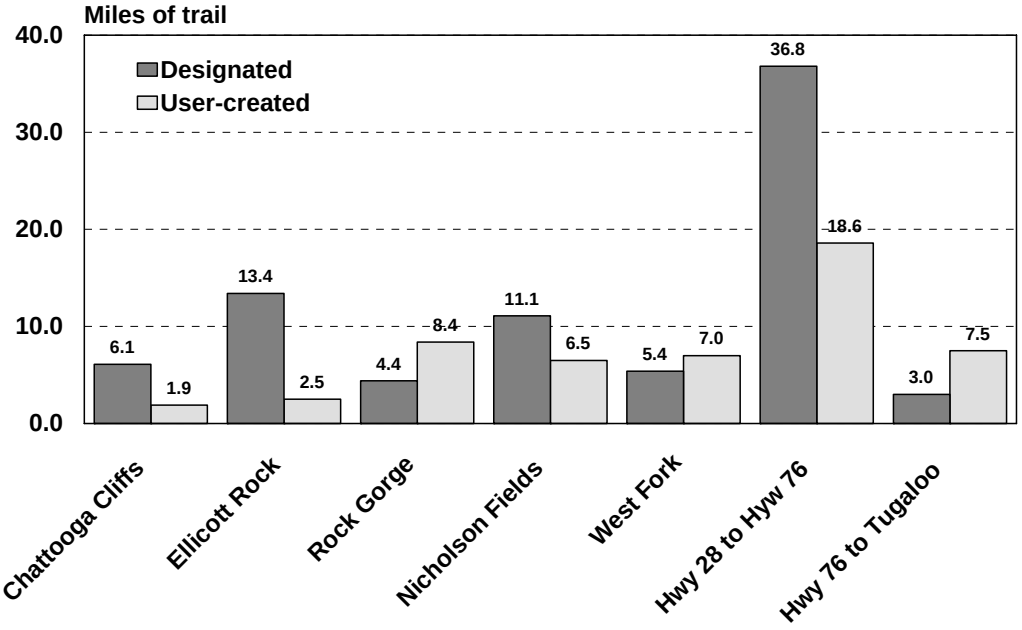

Figure 4. Miles of designated and user-created trails for Chattooga River Segments.

- User-created trails are more prevalent in the Rock Gorge and Nicholson Fields reaches compared to others on the upper river.
- The map produced by the monitoring effort shows the greatest number of user-created trails near Burrells Ford and in the Nicholson Fields Reach. To help "standardize" the miles of user trails for the relative sizes of the different river segments, we calculated the miles of user-trails per mile of river. This analysis showed less than a mile of user-created trails per mile of river for Chattooga Cliffs (0.4), Ellicott Rock (0.5), and Rock Gorge (0.9). Nicholson Fields averaged 2.0 miles of user trails per river mile and lower river segments averaged about one mile of user trails per river mile.

- There were 91 erosion problems observed along trails in the upper river. Just under half (44) of those were in the Rock Gorge segment, with many in the higher use area near Burrells Ford Bridge. There were also 27 in the Nicholson Fields Reach (most near the Highway 28 Bridge), 17 in Ellicott Rock, but only 3 in Chattooga Cliffs.
- The number of erosion sites was "standardized" relative to the miles of trail and the miles of river in each segment. This analysis showed relatively few erosion sites for Nicholson Fields (2.1 sites per trail mile and 6.8 per river mile) and Rock Gorge (2.5 per trail mile and 6.3 per river mile) and fewer for Ellicott Rock (1.1 sites per trail mile and 3.4 per river mile). On the lower river, the highest numbers were for Highway 28 to Highway 76, which includes Section 2 and 3).
- GIS mapping allowed an assessment of the miles of trail that were within 20 feet of the river (which may create a greater erosion threat). For designated trails, about 2% of the mileage was within 20 feet of the river. For user trails, about 10% were within 20 feet, with the highest amount on the West Fork (28% of user trails were within 20 feet). In the Ellicott Rock and Rock Gorge reaches, about 8% of user trails were close to the river. On the lower river, about 9% of the user trails from Highway 28 to Highway 76 were close to the river.
- During the expert boater panel, access to and from the river was at Norton Mill Creek, Bull Pen Bridge, Burrells Ford, and the take-out below Highway 28 Bridge, all using existing designated or user-created trails. To the extent that boaters use existing trails, adding boating use would not produce extensive new trail impacts at these sites unless trails are poorly designed. For example, during the expert panels boaters used a short well-defined trail at Burrells Ford Bridge (downstream on the GA side) to access the river. This trail may have erosion problems that could be exacerbated by boater use (particularly when trails are wet), but reconstruction or use of other existing trails could mitigate such impacts.
- During the boater panel fieldwork, boaters scouted or portaged 5 to 7 rapids between Norton Mill Creek and Highway 28. At the flows during the fieldwork, boaters did not pioneer new routes, and were able to stay below the ordinary high water mark (where soils and vegetation begin) in all but one location. However, one might assume that regular boating use (if allowed) might develop five user trails that are above high water for scouting or portaging at some of these areas. If the average length of these trails is about 100 feet, about one-tenth of a mile of new trails would be developed. This would be less than $1/5^{th}$ of 1% of existing trail miles, about half of 1% of user-created trail miles, and about 4% of existing user-created trails within 20 feet of the river.
- Boating (if allowed) might also create a few new trails to attraction sites that are currently unused by hikers, swimmers, or anglers. The locations and lengths of these trails are difficult to predict, but the sum total is probably similar to the amount described for portage trails (above). As with portage trails, the level of impact depends on soils, trail routing and design, level of use, and timing of use.
- In general, existing or new trails from potential boating appear unlikely to create substantial sedimentation problems from an ecological standpoint. According to a study of sediment sources in the Chattooga watershed, about 2.6% of sedimentation is due to recreation use (presumably trail and campsite site impacts), while 80% is due to road sources, 9% to timber harvest, 4.5% to agriculture, and 2.8% to development (Van Lear, Taylor, & Hansen, 1995). Trail and site impacts are probably more important from an aesthetic / scenic perspective, with highly impacted sites detracting from a "sense of naturalness."

Potential indicators and standards

The initial monitoring report provides a baseline for tracking and managing trail impacts, suggesting several possible indicators:

- Miles of user-created trail (per segment, and standardized per mile of river in a segment).
- Number of erosion problems (per segment, per mile of trail in a segment, per mile of river in a segment)
- Miles of designated trail within 20 feet of the river
- Miles of user-created trail within 20 feet of the river

In all cases, standards could be expressed in terms of change from the baseline condition (even if that baseline is not the condition at the time of WSR designation, which is unknown). The simplest standards might be phrased as "no net increase over 2006-07 levels;" this would address the "no degradation" standard of the WSR Act. If the goal is to enhance resource values, "reduce impact" standards might go further (these are examples):

- Reduce miles of user created trails to less than 0.5 miles per mile of river in a segment.
- Reduce number of erosion problems on designated trails to 0.
- Reduce number of erosion problems to less than 1 per mile of user created trails.
- Reduce miles of designated trail within 20 feet of the river to less than 1% of total designated trail miles.
- Reduce miles of user-created trail within 20 feet of the river to less than 5% of total user-created trail miles.

There is little specific information from existing studies about "how much trail impact is too much" from a visitor or manager perspective. Standards often specify a "no degradation" goal, but establishing more stringent standards is an "improvement" goal based on the assessment of current conditions. If those standards were met with trail design or maintenance projects, more stringent standards (additional improvement) might be contemplated in the future.

Managers should note that the amount of user-created trails does not necessarily indicate a problem. Some user trails follow old logging roads and may be well-designed or access places that are appropriate for visitation. In other cases, user trails may be redundant, part of an expanding social trail network, or poorly located through sensitive areas. A "next step" could evaluate the function and condition of specific user-created trails to determine whether some should be re-routed, eliminated, or turned into designated trails (to be shown on maps, with regular monitoring and maintenance).

Addressing trail impacts

The literature on trail impacts, their effect on biophysical resources, and ways to address them suggest the following considerations:

- Most trail impacts are caused by construction itself (opening tree canopies, soil compaction, changes in drainage patterns, or habitat changes), although heavy use and lack of maintenance can exacerbate problems (Cole, 1999). Most people do not think of designated trails themselves as "an impact," but they represent a change from the natural condition. By designating a trail in a particular "condition class," managers are essentially agreeing that the corresponding level of impact is acceptable.
- Assessing trail impacts requires documenting the length and location of trails and making decisions about the "appropriate" size and condition for their level of use. For example,

wider trails for side-by-side walking may be appropriate in a frontcountry setting but inappropriate in the backcountry. Clarity about the type and condition of designated trails is a way of defining "acceptable" vs. "unacceptable" impacts. In the Upper Chattooga, most designated trails are designed for backcountry settings (single track, narrow tread), but a few follow old logging roads and may be wider.

- Trail impacts occur rapidly from pioneering uses, while recovery occurs more slowly, so the creation of new user trails is often a major issue. User-created trails also may be poorly located or poorly "designed" (even if they access places that are acceptable for people to visit such as satellite camps or fishing holes). An evaluation of these trails can help decide whether they should be left "as is," or redesigned, rehabilitated, or removed.
- The number of people using a trail does not usually determine its condition. By definition, a well-designed trail can withstand intended uses, so increasing numbers seldom increases impact. Unacceptable impacts usually come from poor design, unanticipated use patterns that lead to user-created trails, or unintended uses (such as horse, bicycle, or motorized use of trail designed for foot traffic).
- The primary way that trail impacts are addressed is by redesigning, rehabilitating, or eliminating trail segments. For trails that managers want to rehabilitate or close, barriers such as logs, brush, rocks, or shrub transplants may be more effective than signs. Where re-routing is an option, new alignments should be chosen carefully, particularly as they approach riparian areas and water sources where poor design can exacerbate sedimentation (Marion, 2003).

Litter on trails

Lack of litter is a key component of high quality recreation management, and multiple studies show that it is important to recreation users and managers. The effect of litter on aesthetic evaluations is a major issue, although litter may also affect wildlife, soils, or water quality.

Existing impacts

The Forest Service monitoring project documented the amount of trash (measured in gallons) along designated and user-created trails on public land in the Chattooga basin. Detailed findings are available in that report, but summaries are given in Figure 5 and the bullets below:

- In general, there appears to be more trash along trails in the lower river segments (particularly Sections 2 and 3 from Highway 28 to 76). The amount of trash per mile of trail was also high for Nicholson Fields, West Fork, Chattooga Cliffs, and below Highway 76.
- Review of individual trail data suggests that high amounts for a segment are often influenced by a few areas with considerable trash (over 10 gallons) rather than multiple areas with widespread but small amounts of trash. This suggests that litter impacts are location-sepcific (e.g., sites prone to "dumping") or caused by a small number of inconsiderate users.
- There was considerably more trash on user-created trails than designated trails. This may reflect better agency maintenance, better clean-up efforts by users, or better "norm activation" on designated trails (Vaske, Donnelly, and Whitaker, 2005).

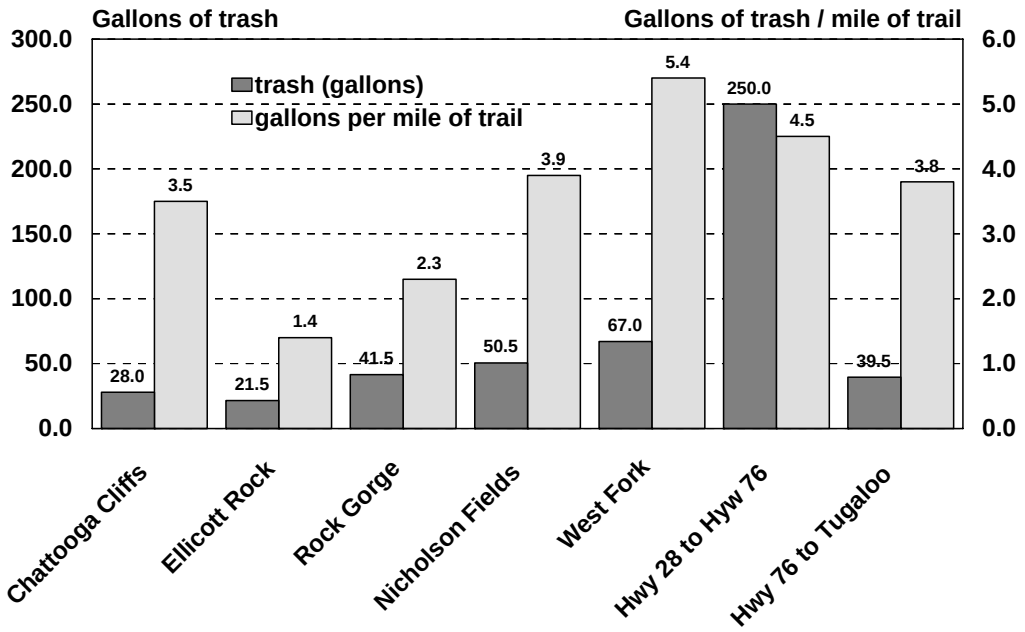

Figure 5. Gallons of trash observed along trails (and per mile of trail) on Chattooga River segments.

- Monitoring was rarely able to determine which types of users were responsible for trash at a site, and this has not been analyzed.
- If boaters were allowed on the Upper Chattooga, they probably would not contribute substantially to ***trail-related*** trash because they would travel along the river rather than trails. However, they might contribute to trash on the short trails used to access the river at bridges. Boating use (if allowed) might also increase litter ***along the river***, just as any additional use has the potential to increase litter. Having noted this possibility, high skilled boaters in hard shell craft are less likely to contribute to litter from capsizing and losing their gear, compared to less skilled boaters using open canoes or rafts (more common on Sections 1, 2, and 3 on the Lower Chattooga).

Potential indicators and standards

The initial monitoring report provides a baseline for tracking and managing trail litter; the obvious indicator is "gallons of litter per mile of trail." A typical standard might be expressed in terms of change from the baseline condition (even if that baseline is not the condition at the time of WSR designation, which is unknown). However, current litter levels strike us as relatively high. If the goal is to enhance resource values, a "reduce impact" standard might be "reduce litter to less than 1 gallon per mile of trail."

Many studies show low tolerances for litter in recreation settings; in most wilderness or backcountry rivers, we have documented close to a "zero tolerance" standard. No specific studies for the Upper Chattooga directly asked users to express a tolerance for litter among trails, although the Ellicott Rock study (Rutlin, 1995) showed that 91% "strongly dislike" litter in campsites.

Addressing trail litter impacts

Few studies have documented a relationship between use levels and litter. Instead, litter appears to be caused by a small proportion of users and correlated with environmental cues (such as the presence of other litter, general condition of the setting) and the strength of norms within recreating groups (Cialdini et al., 1991; Schwartz, 1973; Heberlein, 1971).

Two general approaches are commonly used to address litter impacts: regular maintenance/clean-up activities or directed education/regulation efforts. Clean-up efforts are self-explanatory and limited mostly by agency resources. Education efforts are driven by the belief that people will stop undesirable behavior once they are aware of the impacts it causes. However, littering still occurs despite persuasive social norms against it.

Camp impacts

Camp impacts are an issue on the Upper Chattooga; the primary concerns are the amount of bare ground and cleared area, damaged trees, and litter. Camp site impacts also have an aesthetic component; higher impacts associated with poor camp condition may increase feelings of crowdedness or decrease the sense of remoteness or naturalness.

Existing impacts

USFS monitoring in 2006-07 documented the number of camps, and at each camp estimated the amount of bare soil (in square feet), the additional cleared area (in square feet), the amount of litter at the site (in gallons), and the number of damaged trees in the area. Summarized information is given below; more detailed information is available in the Forest Service report (USFS, 2007).

- There are 97 campsites on the 21 miles of the Upper Chattooga, or 4.6 per mile (Figure 6). This compares to 101 sites on the 32 miles of the Lower Chattooga (3.1 per mile). The highest concentration of camps is in the Ellicott Rock and Rock Gorge segments, with over 8 per mile (but the Rock Gorge segment includes the 30 or so sites in the Burrells Ford walk-in campground).
- Of the 97 sites on the Upper River, about 26 (27%) are within 20 feet of the river. On the lower river, 15% of the camps are within 20 feet of the river. These sites represent greater erosion risks, and violate current regulations that require camping more than 50 feet from water. Over half of the upper river sites close to the river (15 or 57%) are on the Rock Gorge segment.

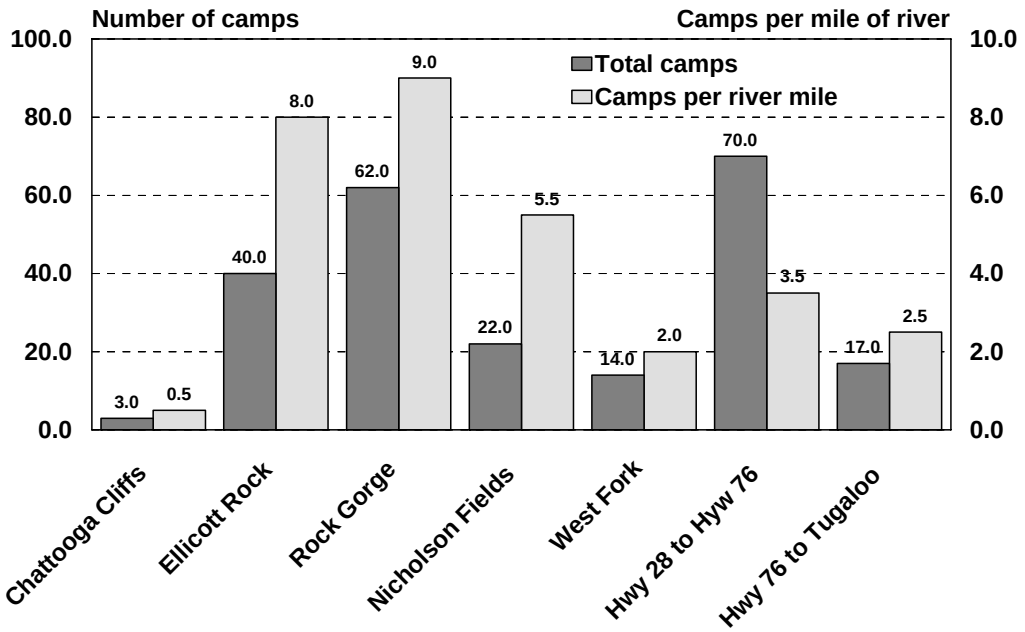

Figure 6. Camps and camps per mile of river for Chattooga River segments.

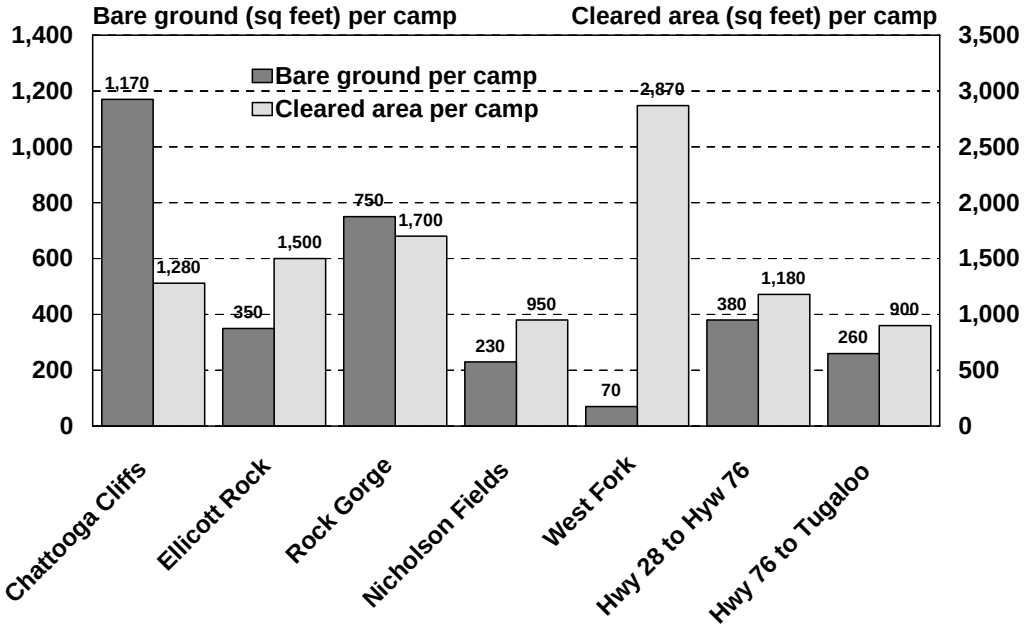

Figure 7. Average bare ground and cleared area per campsite for Chattooga River segments.

- The size of cleared area and bare soil varies considerably from site to site. Some had as little as 100 square feet of cleared area and no bare soil, while larger camps exceeded 4,000 square feet (with more than 2,000 square feet of bare soil). The median amount of cleared area was 1,000 square feet; the median amount of bare soil was 180 square feet.

- Average amounts of cleared area and bare soil are given in Figure 7. In general, the camps with larger cleared areas were on the West Fork and the upper river. The camps with larger amounts of bare soil were in the Rock Gorge and Chattooga Cliffs reaches (although the latter is skewed by having only three sites, one of which was relatively large at 2,500 square feet).
- The amount of trash (in gallons) and the number of damaged trees per campsite varied from site to site. A few had no trash or damaged trees, while others had over 10 gallons of trash and over 20 damaged trees. The average amount of litter was 0.5 gallons; the average number of damaged trees was 5.5.
- Average amounts of trash (in gallons) and damaged trees per camp are given in Figure 8. In general, segment differences were small for damaged trees. There were higher amounts of trash at camps from Highway 76 to Tugaloo Lake, although this was partially an artifact of two sites with 30 and 40 gallons of trash, respectively.
- Monitoring was rarely able to determine which types of users were responsible for trash at a site, and this has not been analyzed.
- If whitewater boaters were allowed on the Upper Chattooga, it is unlikely they would contribute substantially to ***on-river campsite impacts*** because few would camp from their boats. Whitewater boaters generally take day trips in areas with good access, particularly if whitewater is difficult and a boat loaded with overnight gear is a disadvantage. The short duration of boating flows would also encourage day trips to avoid stranding from low flows after a night camping. Among the scenic-oriented boaters, overnight trips would also likely be very rare.
- Although boaters (if allowed) are unlikely to camp from their boats on the Upper Chattooga, many would ***car-camp at dispersed or developed sites***, so boating could increase overall camping use in the area. Using the 1,200 boaters per year estimate and assuming that half camp one night in the area, boating would likely add about 600 camper-nights per year, mostly in the winter and spring.

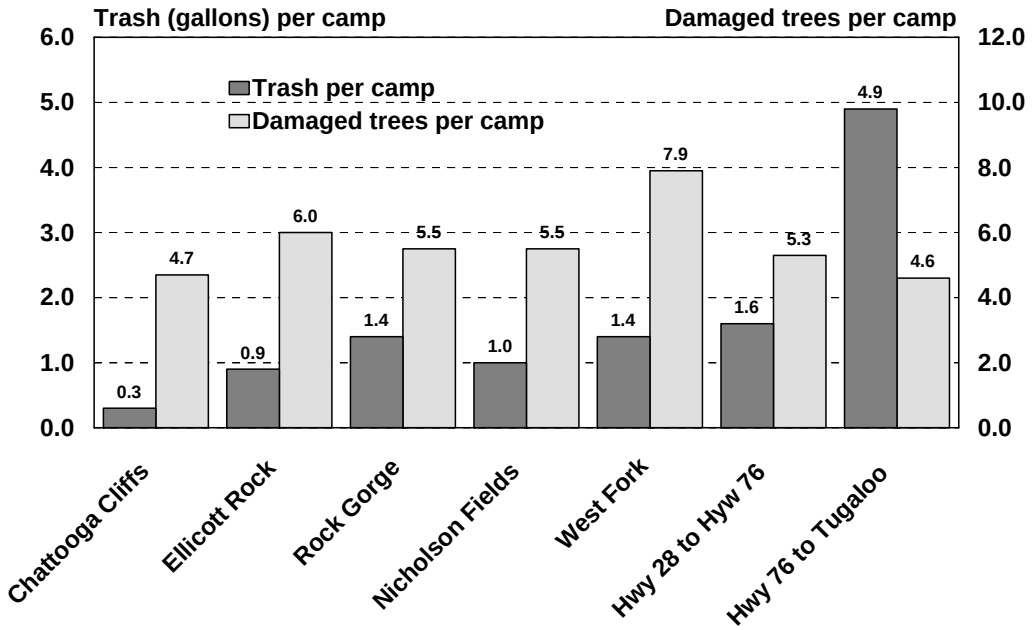

Figure 8. Amount of trash and damaged trees per camp for Chattooga River segments.

Potential indicators and standards

The monitoring report provides a baseline for tracking and managing camp impacts, suggesting several possible indicators:

- Number of camps (per segment and standardized per mile of river in a segment).
- Number of camps within 20 feet of the river (per segment and standardized per mile of river in a segment).
- Median or average square feet of cleared area per camp.
- Median bare soil per camp.
- Average gallons of trash per camp.
- Average number of damaged trees per camp.

In all cases, standards could be expressed in terms of change from the baseline condition (even if that baseline is not the condition at the time of WSR designation, which is unknown). The simplest standards might be phrased as "no net increase over 2006-07 levels" for each; this would address the "no degradation" standard of the WSR Act. If the goal is to enhance resource values, "reduce impact" standards might go further (examples only):

- Reduce camps to an average of less than 5 per river mile (assuming current numbers are too high).
- Reduce the number of camps within 20 feet of the river to 0.
- Reduce cleared areas at the largest camps to less than 2,000 square feet.
- Reduce bare soil at the largest camps to less than 500 square feet.
- Reduce average gallons of trash to less than 0.5.
- Reduce the number of damaged trees at high impact sites to less than 5.

There is little specific information about standards for these indicators from existing Chattooga studies. Establishing more stringent standards is essentially a way of expressing an "improvement" goal based on the assessment of current conditions. If those standards were met with campsite rehabilitation or maintenance projects, more stringent standards might be contemplated in the future.

In setting these standards, managers should note that the number of sites by itself does not necessarily indicate a management problem. However, some sites may be redundant or poorly located in sensitive areas. A "next step" could include evaluating the function and condition of specific sites to determine whether some should be redesigned, rehabilitated, or removed.

Addressing camp impacts

The literature on camp impacts, effects on biophysical resources, and ways to address them suggest the following considerations:

- Studies have consistently found that camp impacts typically occur rapidly during pioneering use (the first few groups that camp in an area). After a site has seen consistent use, additional parties camping on the site induce relatively little change (Marion and Cole 1996).
- Campsite expansion (new satellite campsites, social trails between tent pads, redundant trails to water sources) may be related to large group sizes rather than the frequency with which a camp is used. Group sizes larger than about 10 may trigger these kinds of expansions.
- Damage to trees may cause them to die, detracts from the natural setting, and may induce some micro-habitat changes (Hall & Farrell, 2001).

- Vegetation changes from camp impacts may increase invasive species, which can have indirect effects on wildlife habitat over the long term. Note: The current monitoring effort on the Chattooga did not document invasive species.
- A major concern related to camp impacts in wetter climates (like the Chattooga) relates to erosion and sedimentation. Locating camps away from water sources with drainage that avoids direct paths to the river is the technical fix for this problem.
- Cut trees and similar damage have been categorized as depreciative behavior, but it is unclear whether these result from willful violations or ignorance about appropriate "leave no trace" practices. The former require law enforcement; the latter may be reduced by education efforts (Roggenbuck, 1992).
- Fire ring size and location are an additional camp impact discussed in the literature; they were it was not measured in the present monitoring effort. Fires and fire rings are traditional in Appalachian forest settings (which have available wood and relatively lower fire danger compared to the arid west). Most Chattooga users also oppose restrictions on fires (Rutlin, 1994). However, large, poorly constructed, or litter-strewn fire rings may detract from an area's "naturalness." Most campsites on the Upper Chattooga have fire rings, and some are large; this is an indicator candidate for future monitoring efforts.
- Marion (2003) notes that individual site management actions (e.g., well-defined trails or barriers like logs) can limit the extent and severity of camp impacts by channeling use to more durable surfaces.
- Cole (1987; 1994) notes that durable campsites generally lack of groundcover vegetation or have resistant vegetation, have an open tree canopy, and a relatively flat but well-drained site. Restricting overnight use to designated camps with these characteristics (or otherwise durable locations) is a useful strategy for limiting camp impacts.
- Marion (2003) suggests that resource impacts are primarily related to visitor behavior rather than group size or frequency of use, which argues for an educational effort to encourage low impact camping practices.
- Site closures may be necessary to protect sensitive environments, rare flora and fauna, or fragile historic resources. However, this action results in loss of access and has a heavier managerial footprint (Cole, 1994).

Wildlife impacts

Recreation use has the potential to disturb wildlife or alter their habitat (Anderson, 1995; Cole and Landers, 1995). The literature review regarding recreation impacts on wildlife (Berger, 2007b) describes several impacts, including:

- Direct mortality: the immediate, on-site death of an animal (e.g., from hunting or fishing, off-leash dogs that kill game).
- Indirect mortality: eventual premature death of an animal caused by humans (e.g., poor handling practices during catch and release fishing; feeding wildlife, which may lower their fitness).
- Lowered productivity: reduced reproduction, nesting success, or survival rates due to disturbance or displacement.
- Reduced use of habitat: changes in use of habitat due to human displacement or disturbance.

- Reduced quality of habitat: human-caused impact that lowers the ability of habitat to provide some type of resource to wildlife.
- Behavior/stress: human-cased disturbance affects wildlife behavior, or raises stress levels, which could reduce their long-term fitness.

Substantial impacts on wildlife from recreation use may occur from direct mortality caused by hunting or fishing. However, these impacts are broadly addressed through fish and game management that balances harvest and productivity, or enhances productivity through programs such as fish stocking. As discussed in Chapter 2, those issues are not part of the present analysis. Another major impact relates to large-scale habitat manipulation from land development (which may be recreation-driven), but this is not a major concern in the Upper Chattooga (most of the immediate watershed is protected).

Wildlife impact concerns in backcountry river settings like the Chattooga tend to focus on disturbance effects on reproductive success, use of important habitats, and behavior changes/stress on individual animals. However, assessing these types of impacts is challenging. Species vary in their responses to different types of recreation activity in different settings. Relevant variables include:

- The type, timing, location, and predictability of recreational activity.
- The individual responses of recreation users to wildlife encounters.
- The species, gender, age, life cycle stage, and size of animals involved in encounters.
- Experience of animals with similar encounters (some animals can learn to habituate or ignore human use).
- Environmental factors such as type of habitat, season, weather, food abundance for that year, etc.

Assessing recreation impacts on wildlife requires careful consideration of many variables. The process usually involves identifying sensitive species, considering what is known about how recreation users may interact with it, then assessing potential effects and mitigation options. It is beyond the scope of this report to conduct such an assessment for every wildlife species that may be affected by Upper Chattooga recreation use. However, the literature review (Berger, 2007b) identified key sensitive and indicator species for the Upper Chattooga corridor, and the following summary focuses on the major types of impacts that have been discussed by stakeholders:

Disturbance impacts on birds and mammals

Recreation use may disturb wildlife, and the disturbance response may affect wildlife fitness. There is a large literature on disturbance distances (the distance at which an animal notices or flees from approaching humans) and the conditions under which these events are adverse for various species (Knight & Cole, 1995). Some important findings include:

- Recreation use may displace birds from trail corridors and discourage nearby nesting. Displacement may be temporal (e.g., during high use times) and/or spatial. Whether these effects are important depends on the abundance of bird species and other suitable habitat.
- Dogs, particularly if they are off-leash, generally increase disturbance and displacement.
- The predictability and frequency of trail use may affect the severity of impacts. Effects may depend on how fast people move, predictability of movement, number of people, distance

between people and wildlife, and terrain. These factors are usually more important than the specific recreation activity.

- Some bird species habituate to regular trail use, but still show reactions to off-trail approaches. Recreation users that stay on predictable travel routes are likely to have fewer impacts.
- Waterfowl nesting areas near lakes and rivers are particularly susceptible to disturbance from water-based approaches, especially close approaches by wildlife photographers (Klein, 1993).
- The presence of boats may limit foraging among some birds of prey (e.g., eagles or osprey feeding on spawned-out salmon), but this may benefit related scavenging guilds (e.g., ravens, crows, and gulls) who are less disturbed by people (Knight et al., 1991).
- Fishing may affect bird distribution and abundance, reproductive success, predation rates, and foraging.
- Some bird species can habituate to regular boating use, but may be disturbed by occasional use or boats making closer approaches (Knight and Knight, 1984).
- Habitat fragmentation is probably the greatest threat facing Southern Appalachian black bears (Tankersley, 1996), and it is unlikely that any Upper Chattooga recreation use substantially contributes to this problem. However, black bears during winter hibernation are susceptible to disturbance and usually den farther than 1 to 2 km from roads, homes, or other development. Activity closer than one km sometimes causes den disturbance but researchers apparently did not study the lower level uses such as camping, hiking, or boating. Some bears tolerate disturbance immediately adjacent or even inside dens, but others may abandon them (Linnell, et al., 2000).

It is possible to develop indicators and standards for wildlife disturbance issues, but one must first identify sensitive species and potential recreation impacts, and compare to baseline information. This can require substantial research efforts beyond the scope of the present analysis. During the NEPA phase of the capacity analysis, USFS biologists are expected to qualitatively assess potential impacts on sensitive species.

Even without quantifiable indicators and standards, some river management plans include wildlife impact mitigation efforts. In general, strategies focus direct recreation use away from sensitive habitats, changing how people use an area rather than limiting their numbers. Specific management actions may include:

- Routing trails or travel routes away from nesting sites.
- Closing sensitive areas to camping or other uses.
- Encouraging users to stay on designated trails.
- Education or regulations regarding maintaining appropriate distances from wildlife.
- Time of day restrictions on boating use (to minimize impacts during forage periods).
- Regulations regarding off-leash dogs.

While recreation use can cause adverse impacts on wildlife, the literature also acknowledges benefits such as appreciation of wildlife or support for wildlife management programs. Properly designed trails and campsites can also create new or more diversified habitat (particularly in even-age disturbed forests).

Wildlife attraction impacts

Poor sanitation at campsites can attract animals that become dependent on human food sources. Some Appalachian backcountry areas have problems with black bears, skunks, raccoons, or other rodents getting into campers' food or packs. These behaviors are often unhealthy for wildlife (snack food may be just as poor for wild animals as it is for people), and "begging" or "raiding" incidents may detract from a sense of naturalness (even though some recreation users may like the "close contact" with wildlife).

It is unclear if the Upper Chattooga has significant wildlife attraction problems; recent user surveys did not address wildlife issues, but this could be assessed in future monitoring. A potential indicator variable could be the "number of attraction incidents" for various problem species. The wildlife literature generally supports a "no tolerance" goal for these incidents, and several parks and forests have aggressive programs to reduce or eliminate them (e.g., Great Smoky Mountains, Yosemite). Most management strategies focus on user education or regulations regarding proper food storage and sanitation in camps. Some agencies have "aversive conditioning" programs (for bears), and the Rogue River in Oregon have some camps with agency-provided electric fences to discourage black bears from raiding campers' food. This impact is usually caused by user behavior rather than number of users, and use limits are unlikely to reduce it.

Bank trampling and fisheries impacts

Recreation use can impact fisheries in several ways, but one common issue is bank trampling. Vegetation impacts in riparian zones may occur with even low to moderate levels of use, reducing habitat and cover for fish or other aquatic species (Leung and Marion, 2000; Liddle & Scorgie, 1980; Liddle, 1997). Erosion and trail mileage estimates from Forest Service monitoring effort did not address bank trampling specifically, except to the extent that user trails within 20 feet of the river were identified. Bank trampling typically refers to impacts closer to the water.

Given current Upper Chattooga use patterns, one would expect greater bank trampling impacts near frontcountry (higher use) angling areas, or near heavily used camps. On higher density rivers where bank trampling is a severe problem, education efforts encourage anglers to walk in the stream rather than along the bank. In some frontcountry areas, some reaches may even be closed to fishing for riparian rehabilitation. On Alaska's Lower Kenai River, metal grate walkways keep people from trampling vegetation, but this type of recreation development may not be appropriate in more primitive settings such as the Upper Chattooga.

Effects on salamanders or other amphibians

Stakeholders have discussed potential effects of in-water users on salamanders or other amphibians. Some rare salamanders (e.g., hellbenders, which can exceed 20 inches, and green salamanders) occur in the Upper Chattooga, and critical habitat may include damp rocks and cliffs along the river where recreation users may visit. It is beyond the scope of this report to assess specific impacts from these activities or boaters, but the frequency and extent of in-channel use on the Upper Chattooga is probably limited to a small portion of the river and day. The literature suggests the most substantial threats to these amphibians are related to nearby agricultural uses (which appear correlated with higher sedimentation rates) and purposeful "collecting;" minor impacts might include occasional hellbenders being caught by bait anglers

(Humphries, 2007). The Chattooga has relatively few agricultural impact issues, although sedimentation from roads and and other sources may be an issue (Van Lear et al., 1995). Collecting is also an unlikely activity for current or potential Chattooga recreation user groups. This impact probably does not require a specific indicator and standard.

Lead sinker impacts

Stakeholder discussion has identified "lost lead sinkers" as a possible biophysical impact from angling. This issue is separate from litter that might be associated with fishing; it refers to lead sinkers ingested by animals (usually waterfowl are the greatest concern).

There have been studies on the toxic effects of lead ingested by birds (Pokras & Chafel, 1992; USGS, 1999). However, ingestion of sinkers is generally rare and is limited to "hot spots" with high fishing use and waterfowl feeding areas (e.g., lakes in Minnesota and the Northeast with loon populations who feed by ingesting gravels). In rare cases, this problem has been documented in birds (including eagles) eating fish that have ingested lead sinkers. However, lead does not appear to accumulate in aquatic food chains (fish appear to pass lead through their systems without harm), so widespread effects of this sort appear unlikely.

Some states and countries have banned the use or sale of small lead sinkers (e.g., Minnesota, Maine, New York, Vermont, New Hampshire, Canada, and Britain). The American Sportfishing Association generally supports education efforts rather than statewide or national bans. The primary reason for opposition to non-lead alternatives is their higher cost.

The Upper Chattooga sees regular fishing use, but the prevalence of lead or non-lead sinkers or in angler tackle is unknown. It is also difficult to estimate the amount of sinkers lost into the river. The Upper Chattooga has limited waterfowl populations (although wildlife "openings" are maintained in the Nicholson Fields reach to improve habitat). Relative to other biophysical and social impacts, this issue is probably minor and generally unrelated to the number of anglers (unless they increased by an order of magnitude or more).

Woody material management and Woolly Adelgid issues

Large woody material (LWM) in the river provides cover for fish and can be affected by ecreation use. Logs that span the river, block boat passage, or otherwise create a safety risk are sometimes removed by agencies or boaters, potentially reducing "structure" or changing other ecological functions.

There is currently no assessment of LWM in the Chattooga, nor any formal analysis of whether current levels are a limiting factor for any species. Developing an appropriate indicator and standard for LWM would require such analysis. However, one could develop a "no degradation" standard that would discourage or prohibit LWM removal for boating passage.

Logs prompted 3 to 5 portages (depending upon boater skill levels) during the expert boating reconnaissance (most on the Chattooga Cliffs segment, but also at Big Bend Falls). But more LWM is likely in the future because the *Woolly Adelgid* epidemic has killed many hemlock trees in the Chattooga basin and this will probably introduce more LWM into the river. Whether logs should (or will be) removed if they create boating hazards are open questions (if boating is allowed).

There are extensive debates among boaters and river professionals about the settings and conditions under which it is appropriate to remove LWM for boating (Interagency River Management Workshop, 2007). There is no clear consensus on this issue, which appears to be decided on a case-by-case basis (Hughes, 2007). Variables may include the ecological value of individual logs (not all logs are equally beneficial), the type of boating (log hazards or portages are more problematic for rafters than kayakers), potential impacts from portage trails created to avoid the hazard, level of use, overall "primitiveness" of the river, and specific implications for boaters (is the log a substantial safety threat, or just an inconvenience?).

In many cases, user groups may remove hazardous LWM (Blevins, 2007). There appears to be tacit agency support for some of these efforts, but sometimes there is no agency consultation and formal agreements are rare. Occasional log removal would probably occur on the Upper Chattooga if boating was allowed, but highly skilled kayakers are used to getting under, over, or around log hazards.

The ecological values of aquatic species are "outstandingly remarkable" values on the Metolius and Upper Rogue WSRs in Oregon, and both have management protocols to maintain large woody material. On the Upper Rogue, the "no boating" headwaters segment appears to have been established in part to ensure that woody debris will never be removed for boating passage (the only other year-round non-motorized boating closure on a WSR that we know of). The Upper Rogue is a very small and steep creek with many downed trees crossing the river and a "lava tube" where the entire river goes underground for a short distance, all of which discourage boating on that reach. On the Metolius, a larger river where boating is common, woody debris is managed more aggressively on one reach to allow safe boating passage, but it is generally not removed on another reach to maintain the function of remaining logs (IWSRCC, 2007).

Other impacts

Human waste

Human waste impacts are a common river management topic, particularly when high use is concentrated at popular camps or day use areas. Poor human waste practices can transmit disease through insects or from water-born pathogens, and exposed human waste is an important aesthetic problem for users and managers.

On many western "overnight" rivers, agencies require boaters to use portable toilet systems that virtually eliminate human waste impacts. Similar systems are being developed for alpine areas or other environments where disposal options are limited. These systems require appropriate knowledge and equipment; to date, they apparently are not required or used on many eastern rivers.

Human waste impacts were not specifically monitored during the recent USFS effort, but some impacts were observed during fieldwork at some larger camps. A typical indicator is the proportion camps with some visible impacts, and multiple studies show a "no tolerance" norm.

In addition to regulations that require waste carry-out systems, the most common strategies for reducing this impact include education about proper disposal techniques and agency clean-up patrols. Like litter impacts, human waste impacts are not resolved by use limits (because a small number of people behaving inappropriately can create the "problem").